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REMARKS

Claims 2, 4-6, 8, 10 and 12 have been amended. Claims 1, 3, 15 and 23 been canceled. Applicants request entry of the above amendments, which reduce issues, simply the claims, and do not add any new matter or present any new issues for consideration. Specifically, claim 4 has been rewritten in independent form, eliminating the offensive language subject to rejections under 35 U.S.C. §112, first and second paragraphs. The deleted subject matter has not been taken into consideration during examination. Accordingly, deletion of the objectionable subject matter does not affect the scope of the examination, and overcomes the rejections under 35 U.S.C. §112, first and second paragraphs. Upon entry of the above amendments, claims 2, 4-14 and 16-22 will remain pending and under consideration in the application.

Rejection Under 35 U.S.C. §112

Claims 1-12, 15 and 23 have been rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Claims 1-12, 15 and 23 have also been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Each of these rejections is based on the phrase "each particle having a ratio of surface area of one of the faces of the particle to the thickness of the particle, and the weight average of the ratios being at least 100 or at least 200."

The rejection has been overcome by canceling claims 1, 3, 15 and 23, and by rewriting claim 4 in independent form without the objectionable language.

Rejections Under 35 U.S.C. §103

Claims 1-3, 6-9 and 23 have been rejected under 35 U.S.C. §103 as being unpatentable over Kaminaga et al. (U.S. Patent No. 6,257,215) in view of Chheang et al. (United States Patent Application Publication No. 2003/0100654).

This rejection has been overcome by cancellation of claims 1, 3 and 23, and by amended claims 2 and 6-9 to dependent from claim 4 which has been rewritten in independent form.

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Claims 4, 5, 190 and 11 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kaminaga et al. (U.S. Patent No. 6,257,215) in view of (US Publication No. 2003/0100654) and further in view of Shin et al. (U.S. Patent No. 6,593,404).

The claimed invention would not have been obvious to one having ordinary skill in the art in view of the applied references. The Kaminaga et al. patent discloses the use of a conventional thermosetting epoxy composition employing "72 to 90 weight percent of an inorganic filler material" to encapsulate an electronic component. As stated in the background section of the specification, thermosetting compositions have conventionally been employed for such applications. There is not any prior art of record teaching or suggesting the use of a thermoplastic composition for encapsulating, overmolding or underfilling an electronic component. Specifically, there is not any teaching or suggestion to utilize the thermoplastic compositions disclosed in the Chheang et al. patent application publication for encapsulating, overmolding and/or underfilling an electrical component. To the contrary, the Chheang et al. patent publication teaches hot melt adhesives for bonding between substrates that are to be bonded together (paragraph 0003), with disclosed examples including "package sealing, wood bonding, plastic assembly such as home crafts, fabric bonding, and bonding flexible circuits to substrates." Those having ordinary skill in the art understand that bonding a flexible circuit to a substrate is not the same as underfilling an electrical component.

As stated in the application (paragraph 0001), the function of encapsulating, overmolding and/or underfilling an electronic component is to protect the electrical component from thermal cycling, environmental exposure and/or mechanical impact. There is not any suggestion or motivation for utilizing the thermoplastic compositions of the Chheang et al. reference in place of the thermosetting epoxy compositions of the Kaminaga et al. patent. There is not any indication in the prior art that there is a need to improve adhesion of a composition used for encapsulating, overmolding and/or underfilling an electronic component.

In fact, the Chheang et al. patent application publication does not suggest that thermosetting materials have inadequate adhesive properties. To the contrary, at paragraph 0012, the Chheang et al. patent application publication states that "most thermoplastics do not have sufficient creep resistance and peel strength to perform adequately in some applications in which anisotropically electrically conductive adhesive compositions are used." Chheang et al.

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have attempted to overcome these deficiencies of thermoplastics by utilizing the combination of a semi-crystalline polymer that interacts "synergistically with the organophilic clay component" to achieve "exceptionally fast bonding and rapid development of high creep resistance and peel strength" (paragraph 0056). There is not any teaching or suggestion that the thermoplastic compositions of the Chheang et al. patent application publication would achieve superior adhesion. Instead, there is only a teaching that the inferior adhesive properties of thermoplastics can be improved by adding a clay component.

The prior art fails to teach or suggest that there is any need or desire to improve the adhesion of the epoxy resin compositions used for encapsulating, overmolding and/or underfilling electronic components as taught by Kaminaga et al. The prior art does not provide any expectation that the compositions disclosed by the Chheang et al. patent application publication would achieve better adhesion than the epoxy compositions disclosed by the Kaminaga et al. patent. A feature of the claimed invention is the surprising discovery that a lower amount of filler may be employed to achieve a desired coefficient of thermal expansion (CTE) in a polymeric composition used to encapsulate, overmold and/or underfill an electronic component. As disclosed in the specification (paragraph 0009), the ability to achieve a desired coefficient of thermal expansion with lower filler loading has the advantage of reducing the potential for destruction of the electronic component due to the lower viscosity and lower shear forces exerted on various fragile features of the electronic component during the molding process. The Kaminaga et al. patent teaches a conventional filler loading of about 70-90 weight percent (column 2, line 62), which is needed to adjust the CTE of the polymeric composition so that it more closely matches the CTEs of the semi-conductor device and the heat sink (see column 6, lines 10-21). The prior art references do not provide any expectation that the very low amount of filler loading required by the claims would achieve the required CTE.

The Examiner has stated that "Shin et al. disclose a semi-conductor device comprising a thermoplastic resin composition including an inorganic particulate filler (abstract)." It is respectfully submitted that the Shin et al. patent does not disclose a semi-conductor device. The teaching in the Shin et al. patent that inorganic fillers may be employed in amounts from 0 to 50 parts by weight based on 100 parts by weight of the polymeric composite does not teach

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or suggest the use of such materials for encapsulating, overmolding and/or underfilling electrical components, and does not provide any expectation that a filler loading lower than the 70-90 weight percent disclosed by the of Kaminaga et al. patent would provide the desired CTE.

Finally, it is not obvious to utilize a filler having a platelet-like shape when the primary reference (Kaminaga et al.) expressly teaches that the inorganic filler "may be a rounded filler, such as for example fused silica, in order to reduce or minimize risks of damage at semi-conductor components." While this does not suggest that platelet or other non-rounded fillers cannot be employed, it would tend to lead those having ordinary skill in the art away from the use of non-rounded fillers, absent specific motivation to utilize non-rounded fillers. The prior art does not provide such motivation. The suggestion to add clay fillers to thermoplastic hot melt adhesives to enhance certain adhesive properties is not germane to the processes and articles described by Kaminaga et al.

The Examiner has also stated that one having ordinary skill in the art would be motivated to utilize the hot melt adhesives disclosed by the Chheang et al. patent application publication for encapsulating, overmolding and/or underfilling an electrical component because it would "improve electrical stability (paragraph 0017)." The prior art does not provide any teaching or suggestion that the use of epoxy thermosetting packages as disclosed in the Kaminaga et al. patent presents any problems relating to electrical stability. Further, it should be noted that the improved electrical stability referred to in paragraph 17 of the Chheang et al. reference relates to improved electrical stability in response to applied mechanical stresses for anisotropically electrically conductive adhesives. Rather than disclosing electrically conductive adhesives, the Kaminaga et al. patent teaches that the epoxy materials used for encapsulating electronic components are dielectric materials (column 3, lines 26-31).

Thus, utilizing clay fillers as taught by the Chheang et al. reference in the filler amounts disclosed by Shin et al. patent in place of the epoxy compositions containing 70-90 weight percent filler to encapsulate, overmold and/or underfill an electrical composition as taught by Kaminaga et al. patent requires utilizing a lower amount of filler than the prior art teaches is necessary to achieve the desired CTE, and utilizing platelet-shaped fillers when the prior art teaches that rounded fillers are desired for underfilling, overmolding and/or

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encapsulating electronic components to avoid damage. The disclosed advantage of utilizing platelet-shaped clay fillers relates only to improving adhesive properties of thermoplastic polymers and improving electrical stability of electrically conductive hot melt adhesives. Neither of these factors is relevant to the dielectric, thermosetting epoxy compositions of the Kaminaga et al. patent. In view of these considerations, it is respectfully submitted that those having ordinary skill in the art would not be motivated to modify the teachings of the Kaminaga et al. patent by employing the Chheang et al. thermoplastic compositions.

Claim 12 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Kaminaga et al. in view of Chheang et al. and further in view of Capote et al. (U.S. Patent No. 6,335,571).

Dependent claim 12 is allowable for at least the reasons set forth above with respect to claims 4, 5, 10 and 11. Specifically, the Capote et al patent does not provide any further teaching or suggestion that would lead one having ordinary skill in the art to achieve the required CTE utilizing a very low filler loading of particles having a platelet structure. To the contrary, the Capote et al. patent teaches that the encapsulant polymer resin "is filled with a sufficient amount of silica powder to produce the desired coefficient of thermal expansion and elastic modulus" (column 8, lines 25 -30).

Claims 13, 14 and 16-20 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kaminaga et al. in view of Shin et al. The Examiner has admitted that the Kaminaga et al. patent only discloses the use of a thermosetting epoxy resin for encapsulating, overmolding and/or underfilling an electrical component, and fails to disclose the use of a thermoplastic resin matrix for encapsulating, overmolding and/or underfilling an electrical component. However, the Examiner has incorrectly stated that "Shin et al. disclose a semiconductor device comprising a thermoplastic resin composition including an inorganic particulate filler (abstract)." The Shin et al. patent discloses a thermoplastic resin composition that may include from 0 to 50 parts by weight of conventional additives (such as inorganic fillers, thermal stabilizers, antioxidants, light stabilizers, plasticizers, pigments, dyes, and mold releasing agents) per 100 parts by weight of the base resin. However, this does not suggest that such compositions are suitable for encapsulating, overmolding and/or underfilling electrical components, and could be substituted for the thermosetting epoxy resins disclosed by

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Kaminaga et al. patent. Because the rejection appears to be based on a misunderstanding regarding the teachings of the Shin et al patent, it is respectfully submitted that withdrawal of the rejection is most appropriate. However, in the alternative, it is respectfully submitted that the rejection, if maintained, should be reformulated to eliminate the misstatement that the Shin et al. patent discloses a semi-conductor device.

Further, those having ordinary skill in the art would not be motivated to utilize the materials disclosed by Shin et al. for encapsulating, overmolding and/or underfilling an electrical component as taught by Kaminaga et al. Specifically, those having ordinary skill in the art would not expect the compositions of Shin et al. to achieve the required CTE. The Kaminaga et al. patent expressly discloses that a high filler loading of from about 70 to about 90 percent is needed to appropriately adjust CTE. Finally, the use of conventional fillers such as those disclosed by Shin et al. would not be capable of achieving the desired CTE disclosed by Kaminaga et al. patent.

Claim 15 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Kaminaga et al. in view of Shin et al. and further in view of Chheang et al.

This rejection has been overcome by canceling claim 15.

Claims 21 and 22 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kaminaga et al. in view of Shin et al. and further in view of Yu et al.

Dependent claims 21 and 22 are allowable for at least the reasons set forth above with respect to independent claim 13. Further, the Yu et al. patent does not provide any expectation that desirable underfilling, overfilling and/or encapsulating properties can be achieved by substituting a thermosetting matrix containing silica filler as disclosed by Kaminaga et al. with a composition comprising a thermoplastic resin matrix and glass sphere filler.

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CONCLUSION

In view of the above amendments and remarks, withdrawal of the rejections and allowance of the claims is appropriate.

Respectfully submitted,

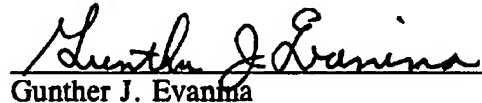
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